



(11) **EP 0 743 792 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**20.11.1996 Bulletin 1996/47**

(51) Int Cl.<sup>6</sup>: **H04N 7/15**

(21) Application number: **96303038.2**

(22) Date of filing: **30.04.1996**

(84) Designated Contracting States:  
**DE FR GB**

(30) Priority: **16.05.1995 US 442207**

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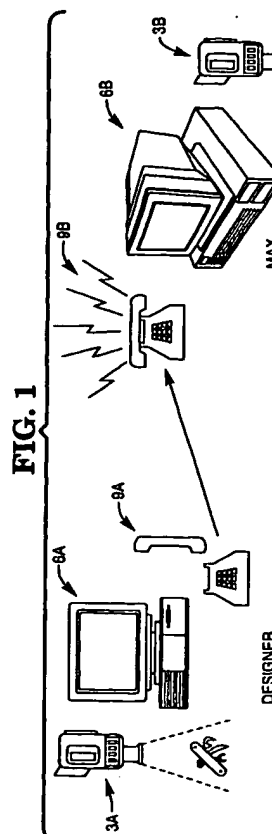
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(54) **Video conferencing system**

(57) To initiate a video conference, an exploratory telephone call is made to a party, using a first telephone channel, in order to enquire whether the party wishes to hold a video conference. If the party does, the caller then causes the establishment of an initial video conference on a second data channel, without disrupting the existing telephone call. Then, after the video conference has been established, the exploratory telephone call is terminated, and the first channel is used to carry the video conference data, along with the second channel, and the audio connection is re-established by merging audio information with video information.



## Description

This invention relates to video conferencing systems.

Video conferencing systems exist today, and their use will become more widespread as time progresses. In a typical video conferencing system, all participants in the conference, who are present at different locations, are equipped with video cameras, video displays, audio microphones and audio speakers. This equipment allows the users to see and speak with each other, as though present at a single conference table, in a single room. In addition, the video cameras and displays allow a participant to present materials of interest to the other participants, such as documents or physical objects, as though making a live, personal presentation.

In general, setting up a video conference requires some delays, for several reasons. One is that computers are involved in handling the audio and video signals used in the conference. These computers must, of course, be operative, which requires that they be switched on. Switching-on requires that they run through their initialization routines, which takes time.

Even if the computers are up-and-running, and require no switching, nevertheless, in establishing the video conference, the computer at each participant's location must do things such as (1) agree on modes of data transfer with another computer and (2) run preliminary tests of data transfer, and of certain equipment. Thus, establishing a video conference can require a delay of several seconds, if the computers are up-and-running, or a minute or more, if the computers must be initialized.

Further, the delay is in addition to the inherent delay in placing a telephone call. The computers must dial telephone numbers, and wait for other computers to answer the calls.

It is an object of the present invention to provide a method of establishing a video conference, which is rapid and convenient in use for participants to the video conference.

Therefore, according to the present invention, there is provided a method of establishing a video conference, characterized by the steps of: making an audio telephone call; and establishing the video conference while the audio call is in effect.

It will be appreciated that a method according to the invention has the advantage that the participants can still talk while the video conference is being established.

One embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which:-

Figures 1 - 4 illustrate a sequence of events which will occur during use of the invention; and  
Figures 5 - 11 contain a flow chart explaining events which occur during operation of the invention.

Figure 1 illustrates some of the video conferencing equipment used by two conference participants. Each participant has a video camera 3, shown individually as 3A,B, a micro computer 6, shown individually as 6A,6B, and a telephone 9, shown individually as 9A,9B. Audio microphones and speakers are also used, but not shown.

Assume that the two participants are located in different cities, but are working on a common project, such as development of a new pocket knife. One example of their use of the invention would be the following.

The knife designer would pick up telephone 9A, as indicated by the off-hook receiver, and call Max, the advertising manager. It is preferred that, at this time, the designer's computer is running, because the designer's computer will be called upon to dial a second telephone number, as will be explained shortly.

Max's telephone 9B rings, as indicated. When Max answers the audio call, telephone 9B goes off-hook, as indicated in Figure 2.

The knife designer now asks whether Max would like to see the new knife, as indicated in Figure 3. If Max says "Yes," then the knife designer actuates the invention, which establishes a video conference, and the knife appears on Max's display.

Significantly, during the initialization procedure for the video conference, the original telephone conference was not disrupted in any significant way. The parties can maintain conversation while the video conference was being set up, and can discuss the progress of the set-up which they observe.

Figures 5 - 11 provide a flow chart which explains the logic followed by the invention, and are considered self-explanatory.

The invention can be used with commercially available video conferencing systems such as the TeleMedia Connection, available from NCR Corporation. This conferencing system utilizes the commercially available ISDN telephone service. This service provides three channels, or "lines," to the user. The invention uses one of the lines in making the initial audio call.

When the called party answers the call, and indicates that a video conference should be undertaken, the caller actuates the invention, preferably by making a selection on a pull-down menu on a computer. The invention then calls the called party's computer, or video conferencing system, using another ISDN channel, and establishes the video conference. During this establishment, the initial audio call, on a first ISDN channel, is undisturbed.

The ISDN channels impose limited bandwidth. The two main channels allow approximately 64 kilobits/second. A third channel is available, which carries certain control signals, and has a significantly reduced data capacity.

Because one 64K channel is used for the initial audio call, the bandwidth available for another call, such as the video conference, is restricted to that in the other

channel, namely 64K. Consequently, when the video conference is first established, using this single 64K channel, the video images will be somewhat jerky, and otherwise deficient, compared to the video which can be transmitted using two 64K channels.

To remedy this situation, after the video conference has been established, the bandwidth of the first channel is then devoted to the video conference. That is, the following events take place:

1) The initial audio call is terminated, just as though one of the parties placed a telephone on-hook. At the same time, the audio call is multiplexed into the video conference signals. The parties will hear a small click, or glitch, at this switchover, but their conversation will not be otherwise interrupted.

2) Now the audio channel, used by the initial call, is free. This channel is now used to carry the overall conference signals. The conference signals (video plus audio) are now distributed over the available channels, namely over two 64K channels. Now, optimal bandwidth is available for the video signal, and the jerkiness, and other deficiencies, disappear.

It may seem peculiar that the initial audio call is actually terminated, or "hung up," and then re-established, in order to devote the first channel to carrying conference information. It may be thought that the connection could be maintained, while the invention simply displaced the audio signal by the conferencing signals.

However, this approach is not feasible at this time. The reason is that the ISDN system requires that the user initially specify the type of information which is being sent (voice or data), at the beginning of a call. It is, in general, not feasible to switch from one type to the other during a call.

Because of the termination and re-dialing of the audio call, the user's computer contains the required telephone numbers to automatically dial the called party, via the several ISDN channels.

The video data is preferably transferred using IEEE (Institute of Electrical and Electronic Engineers) standard H221.

Both the audio telephone call and the video conference call can be viewed as essentially involving the transfer of information. Thus, placing the initial, exploratory audio call, using an ISDN channel in voice-transmission mode (or audio mode), involves transfer of audio information; establishing the initial video conference, using an ISDN channel in data-transfer mode, involves transfer of video information; and establishing the final video conference, using multiple ISDN channels in data-transfer mode, involves transfer of both audio and video information. The audio information becomes merged, or multiplexed, with the video information.

Viewed another way, the communication, either audio or video, is made possible by transfer of information. The information transfer supports the audio and video

communication.

One aspect of the invention involves dynamic bandwidth allocation. For example, the exploratory audio call, on a first channel, consumes some of the ISDN's total bandwidth capacity. Establishing the initial video conference, on a second channel, consumes additional capacity. Terminating the audio call frees the bandwidth of the first channel, which, together with the second channel, is used to carry the final video conference.

During the initial, exploratory, audio call, far less information is carried by the first channel than is possible. As stated above, the first channel has a capacity of 64,000 bits/second. An ordinary telephone channel, which is capable of carrying this exploratory call, has a bandwidth of about 3,000 Hz.

Thus, during the exploratory call, a channel having a 64,000 bits/second capacity is used to transmit a message which ordinarily can occupy a 3,000 Hz bandwidth. This inefficiency is tolerated, in order to reduce the risk of spending the time to establish a video conference, and finding that other participants cannot attend.

As Figure 8 indicates, near the bottom, a situation called "TV Privacy" may arise. This refers to the fact that the called party's video camera may have been deactivated. If so, the invention takes the actions indicated. In practice, the calling party will probably notify the called party of this deactivation, during the exploratory audio call.

It should be understood that a video conference can be termed a "video call," and an ordinary telephone call can be termed an "audio call."

The preceding discussion has been framed in terms of a single caller holding a video conference with a single other party. The extension to multi-party conferences is straightforward. In particular, it is expected that one person will initiate a video conference, by making exploratory audio calls to the other participants. These calls, in effect, establish a telephone conference, as done in the prior art, with the exception that one channel of an ISDN line is being used, instead of an ordinary telephone line. Then, when all participants are connected in the conference call, the switchover to a video conference is made.

During a video conference, three types of information are transferred: audio, video, and pure data. When the audio call is merged into the video call, there is a 4-to-1 compression of the audio data. Video data, because of its varying amount of redundancy, is compressed varying amounts during the conference. (Video data is that captured by one of the video cameras shown in Figure 1.) Both types of compression (audio and video) are lossy.

In contrast, when pure data is transferred, such as a computer file contained on a disc drive of a conference participant, a non-lossy compression is undertaken.

**Claims**

1. A method of establishing a video conference, characterized by the steps of: making an audio telephone call; and establishing the video conference while the audio call is in effect. 5
2. A method according to claim 1, characterized in that said step of making an audio telephone call includes the step of placing a telephone call to a potential conference participant, using a voice transmission mode of a first channel of a multi-channel telephone service. 10
3. A method according to claim 2, characterized in that said step of establishing a video conference includes the step of, after the participant answers the telephone call, using a data-transmission mode of a second channel of the multi-channel telephone service. 15 20
4. A method according to claim 3, characterized by the steps of: terminating the use of the first channel, while maintaining video communication using the second channel; re-establishing the first channel in a data transmission mode; merging information supporting the audio telephone call with information supporting the video call; and using both the first and second channels to support the video conference. 25 30

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FIG. 1

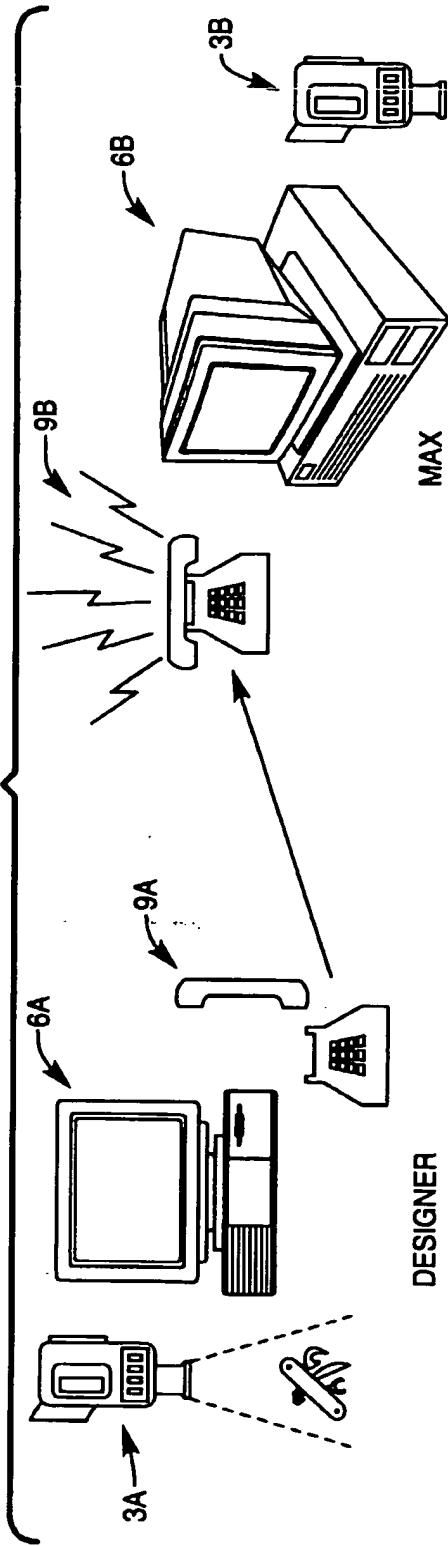


FIG. 2

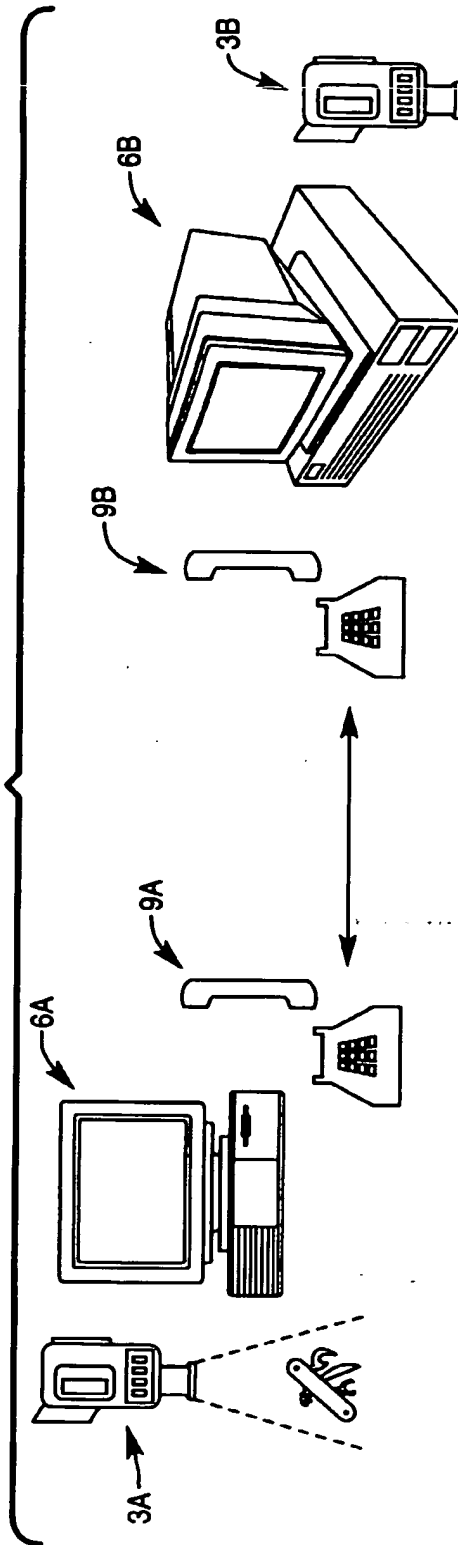


FIG. 3

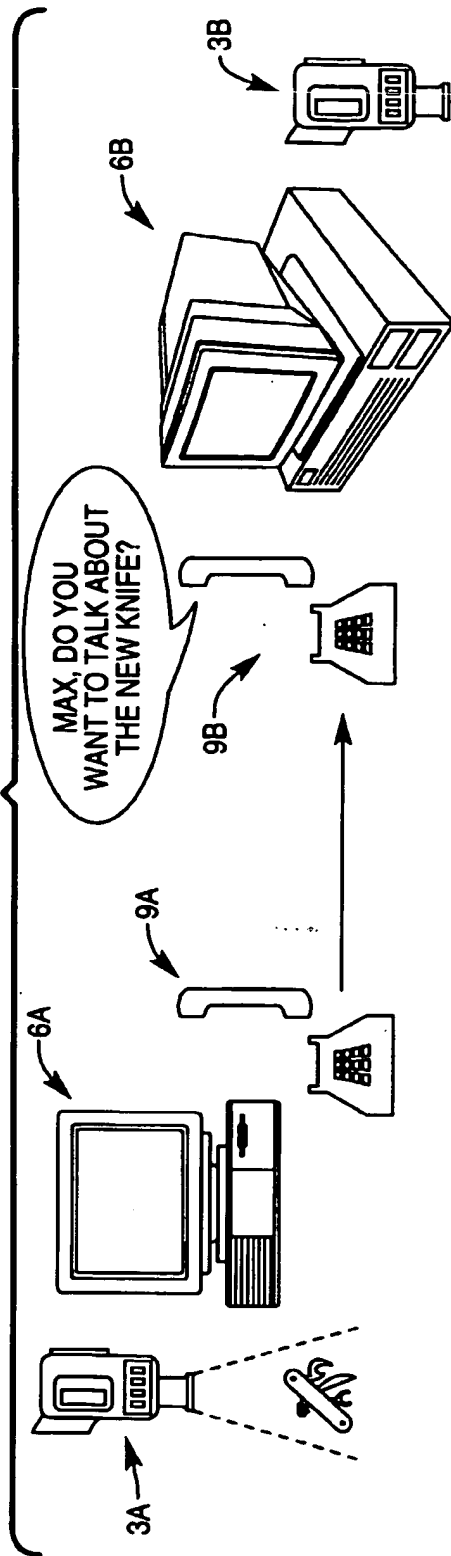
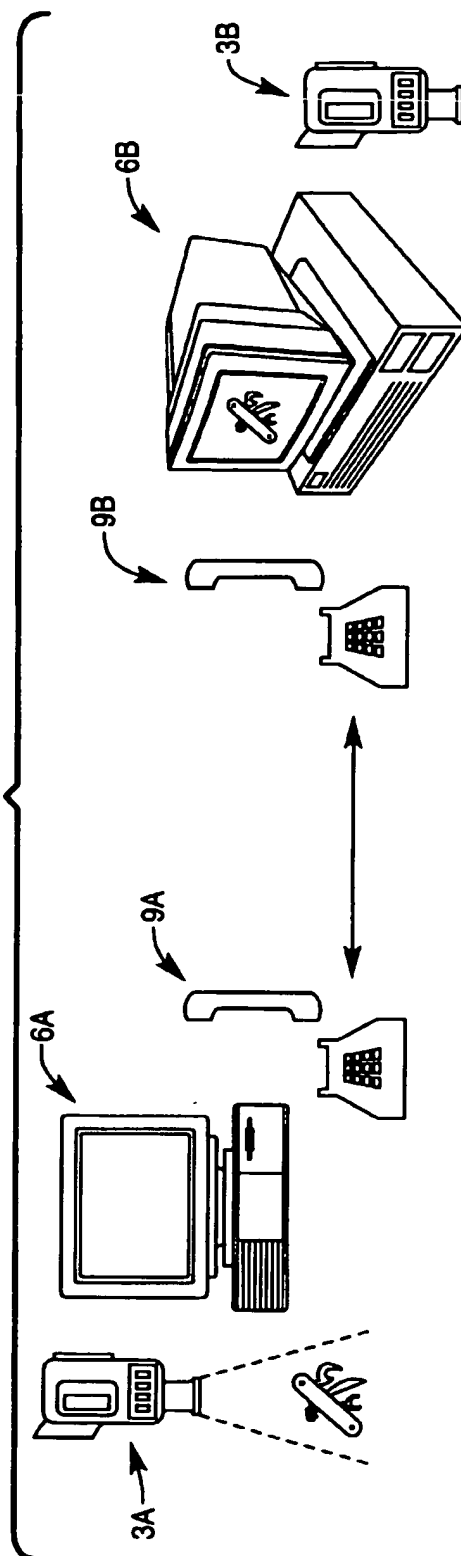
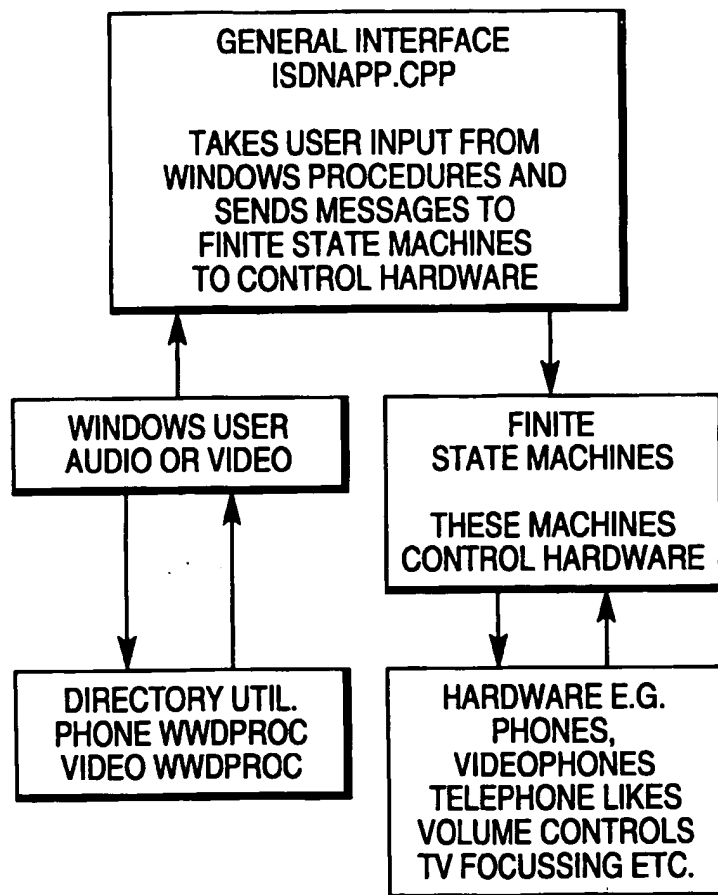
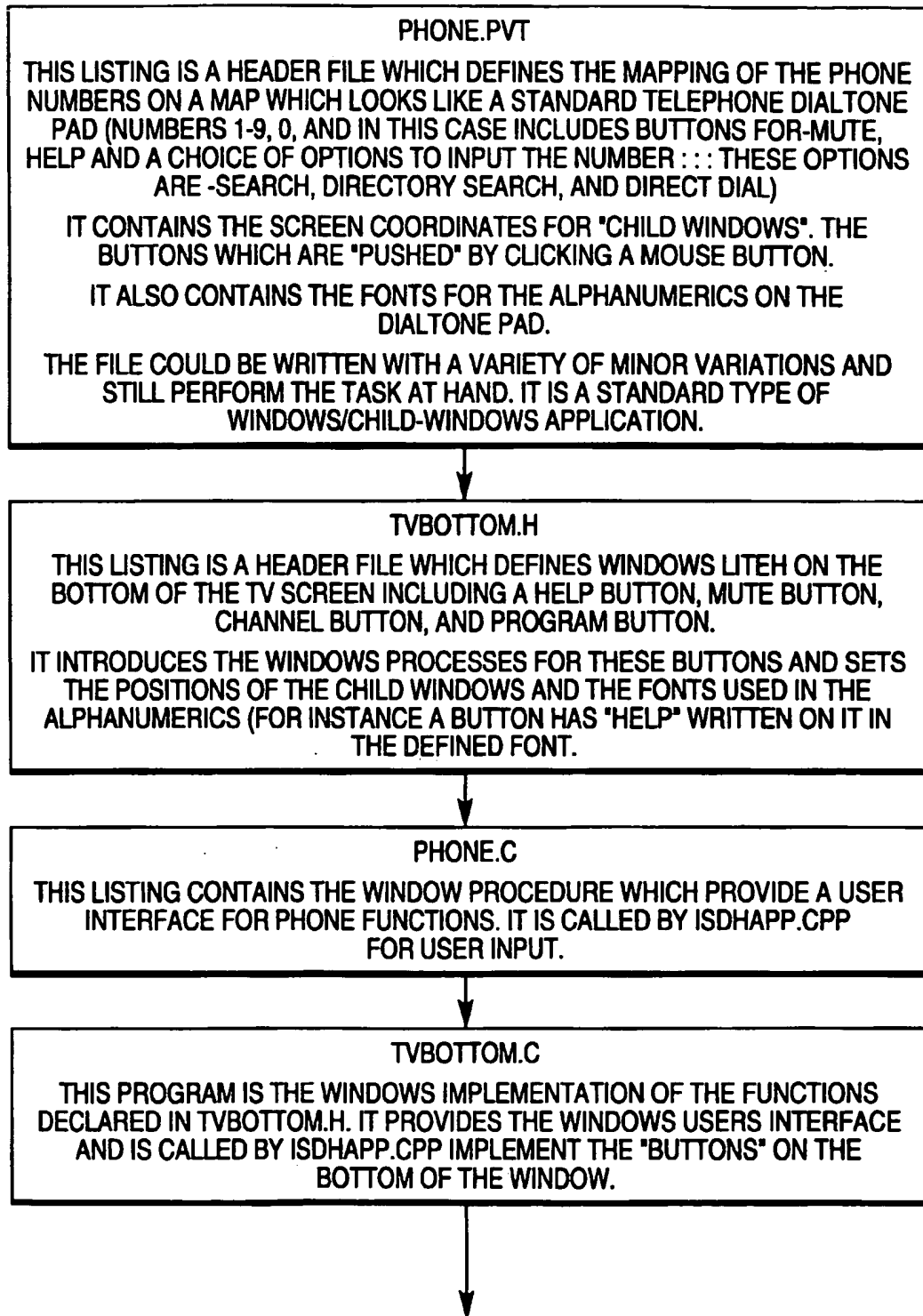


FIG. 4

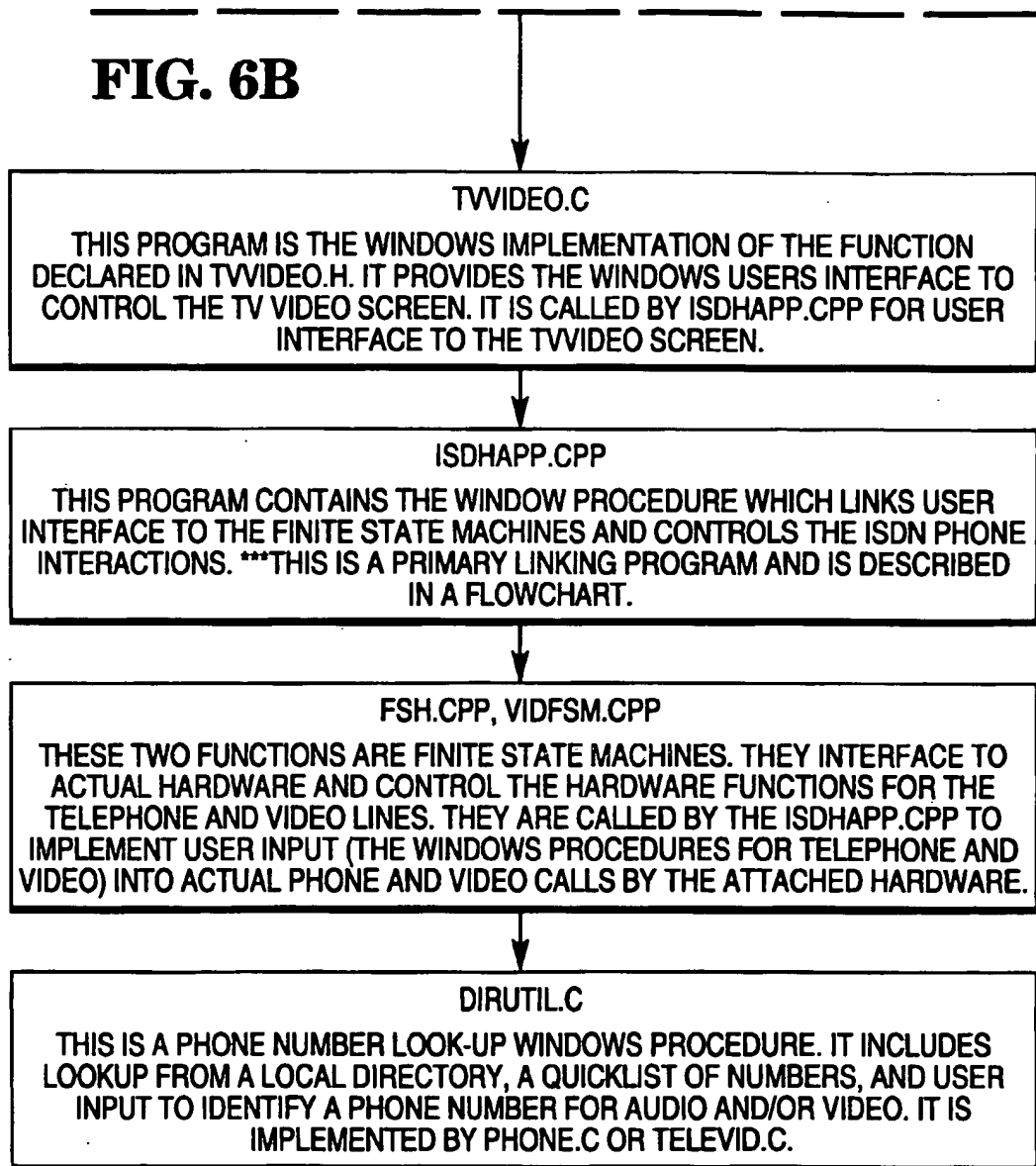


**FIG. 5**

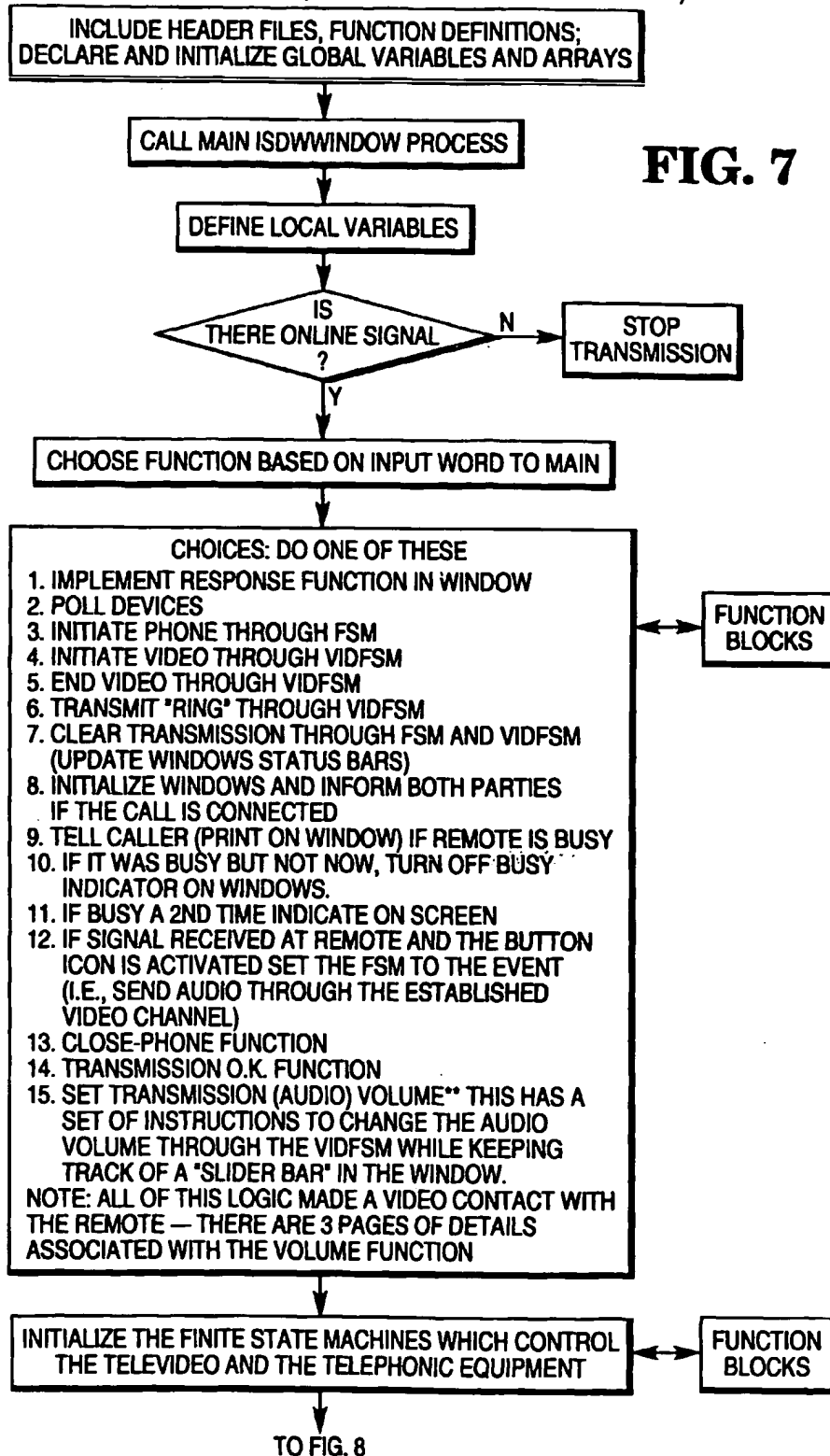


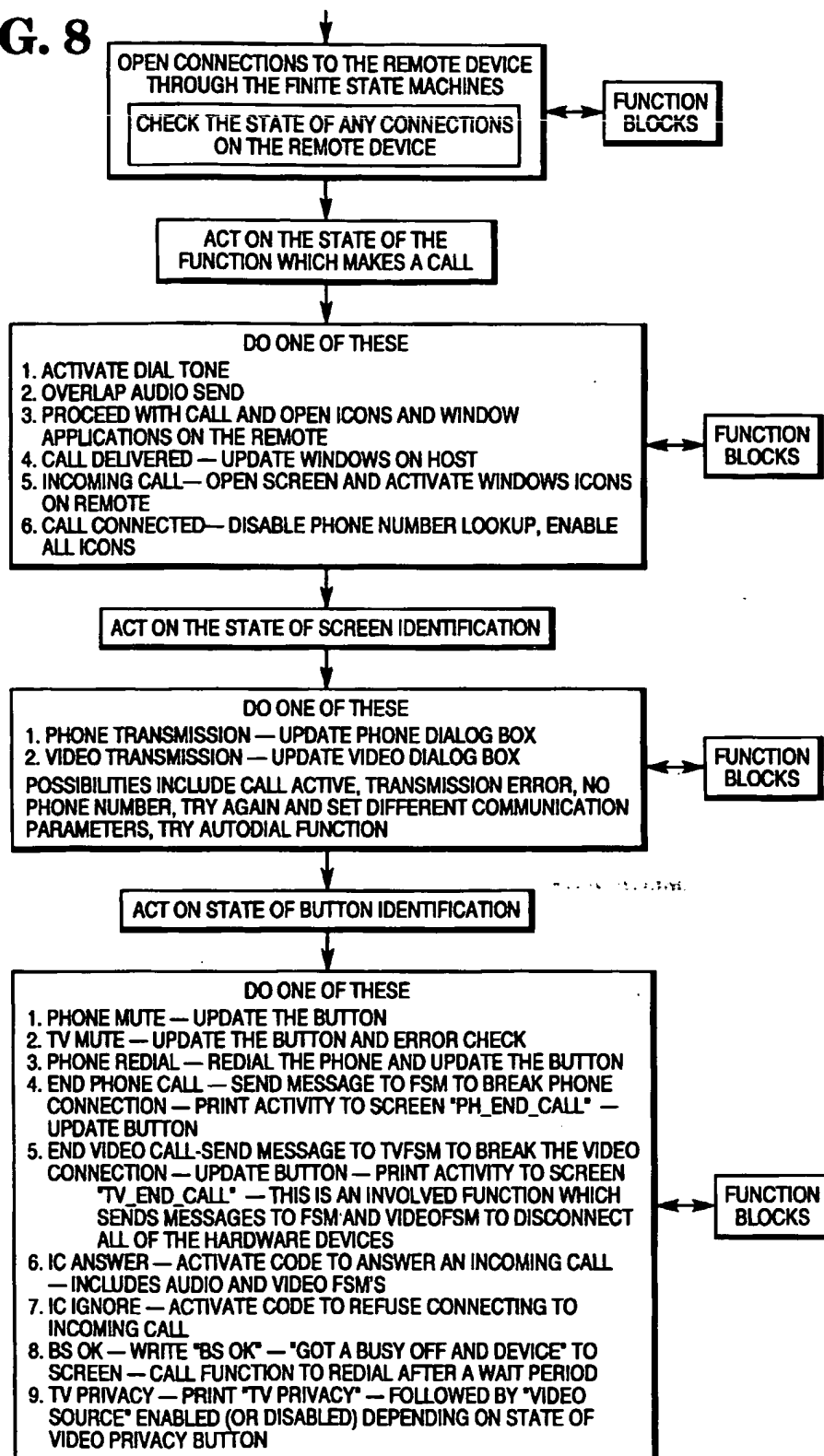
**FIG. 6A**

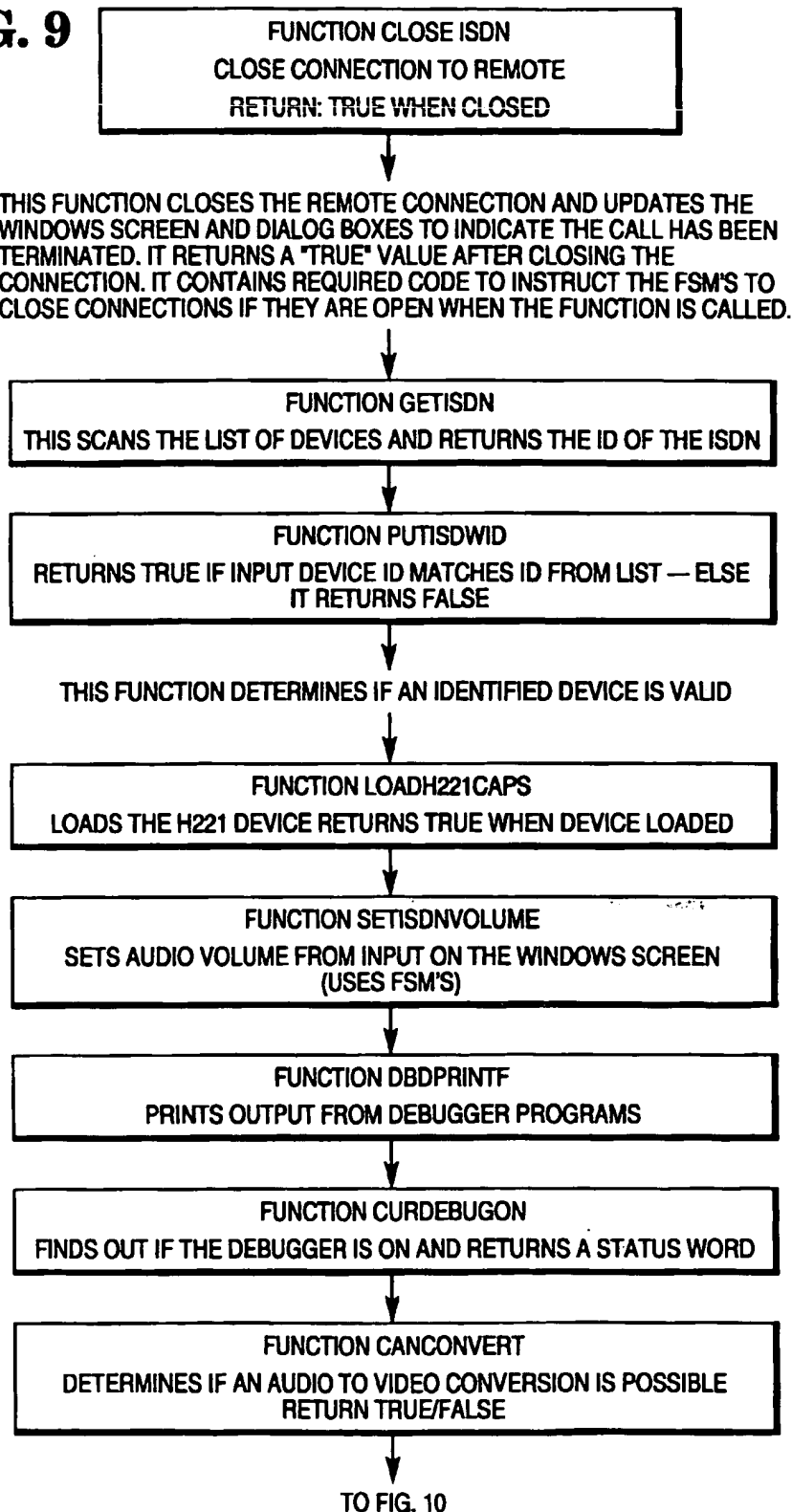


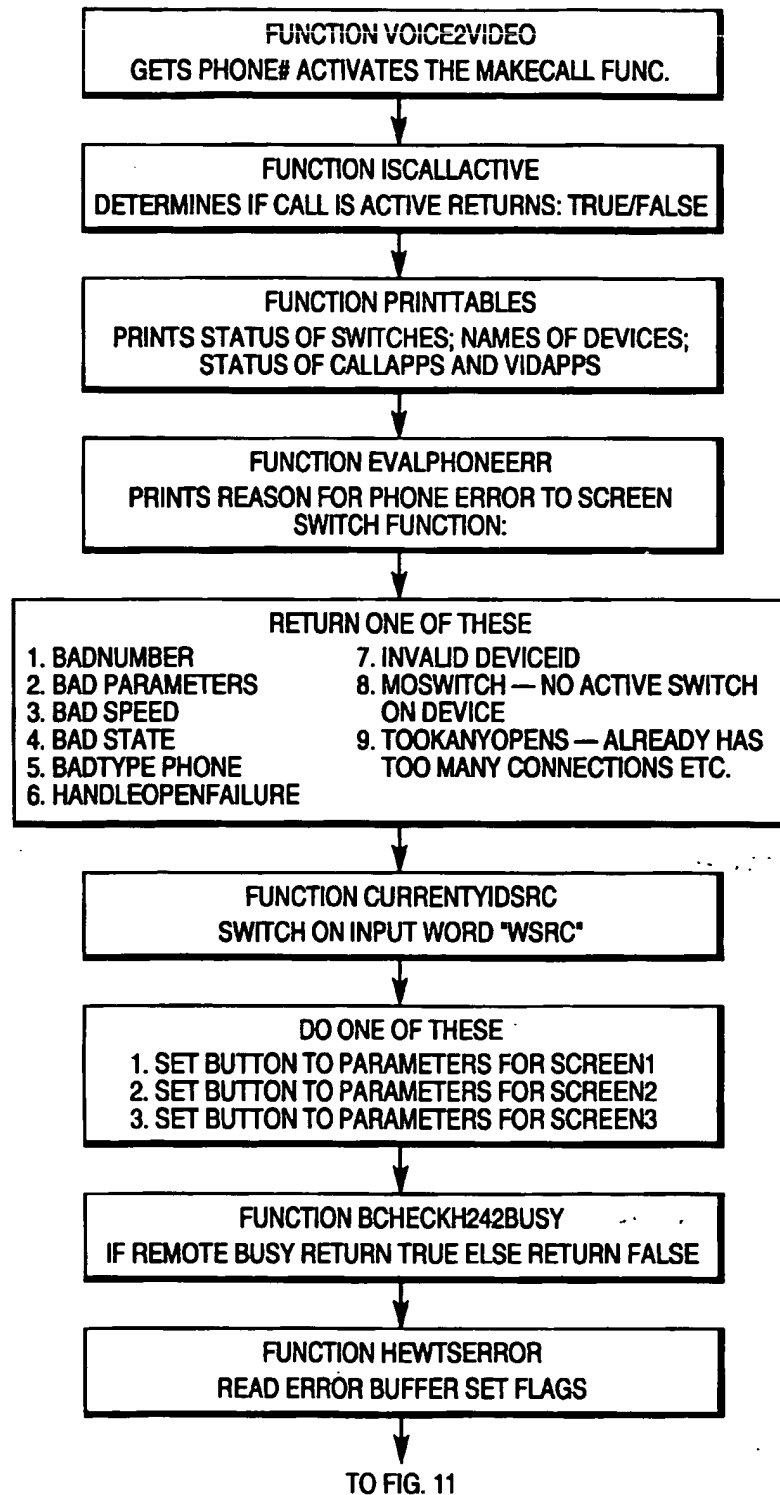
**FIG. 6B**

## FLOWCHART FOR ISDNAPP.CPP (CONTAINS VOICE2VIDEO FUNCTION)

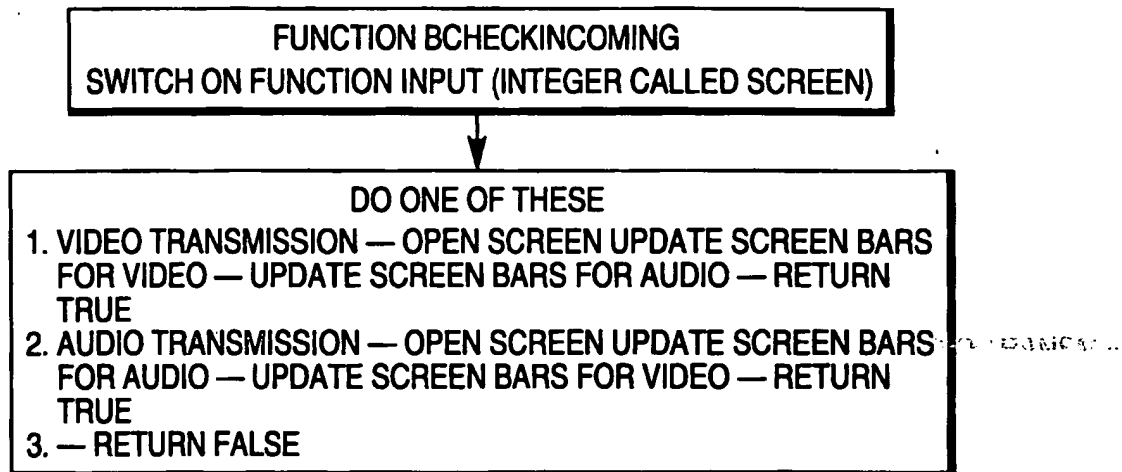


**FIG. 8**

**FIG. 9**

**FIG. 10**

**FIG. 11**





European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 95 30 3038

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 535 890 (CANON KK) 7 April 1993 * page 3, column 3, line 45 - column 4, line 5 * * page 6, column 9, line 36 - column 10, line 22 * * page 7, column 12, line 6 - line 47 * * figures 8,10 * ---	1-4	H04N7/15
X	IEEE COMMUNICATIONS MAGAZINE, vol. 30, no. 5, 1 May 1992, NEW YORK, NY, US, pages 38-43, XP000321469 AHUJA S R ET AL: "COORDINATION AND CONTROL OF MULTIMEDIA CONFERENCING" * page 39, right-hand column, line 46 - page 41, left-hand column, line 38 * * figures 2,3 * -----	1-3	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H04N
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		30 July 1996	Van der Zaal, R
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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